COLD WEATHER PLACEMENT

The following chart will be used to determine allowable temperature and wind conditions for concrete placement during cold weather. Air temperature and wind velocity measurement should reasonably represent conditions at the site of concrete placement.

When the air temperature is below 2°C (35°F), determine the wind velocity using available wind velocity measuring equipment. Velocity determination should disregard wind gust and be based on a steady and reasonably sustained wind velocity. When the equivalent temperature is -15°C (5°F) or above and is expected to remain above -15°C (5°F) for the time required to complete the units involved, concrete may be placed provided the forms are covered and preheated and the concrete temperature is controlled. All forms must be covered with a suitable cover prior to concrete placement and the entire line preheated to at least 5°C (40°F)(The entire preheated line shall include forms, strands and reinforcing steel). Remove the covers only where concrete is being placed or finished and immediately replace them on the finished units. The concrete temperature must be maintained at 5°C (40°F) or higher at all times during the concreting operation. This procedure shall be followed until the concrete for the entire line has been placed.

Air Temp.		Wind Speed		Air Temp.		Wind Speed	
°C	°F	Kph	Mph	°C	°F	Kph	Mph
2	35	48	30	-8	18	13	8
1	34	44	27	-9	16	11	7
0	32	35	22	-10	14	10	6
-1	30	29	18	-11	12	10	6
-2	28	24	15	-12	10	8	5
-3	26	21	13	-13	8	8	5
-5	24	18	11	-14	6	6	4
-6	22	16	10	-15	5	6	4
-7	20	14	9				

When the wind velocity is greater than indicated on this chart for any corresponding air temperature, the equivalent temperature is below -15°C (5°F). No concrete shall be placed when the air temperature or equivalent temperature is below -15°C (5°F).

If it is desired to place concrete when the air temperature or equivalent temperature is below -15°C (5°F), suitable housing would be required to control the surrounding temperature. Approval of this housing system would be based on consideration of the temperature effect on the entire line.

PRECAUTIONARY NOTES

- Pallets may buckle due to temperature changes. The condition of the line should be checked immediately before commencement of concrete placement.
- Ensure no frozen material is incorporated.

- All snow, ice, and frost shall be removed from steel and forms.

- After placement and vibration, the concrete shall be allowed to attain its initial set before steam is applied. Otherwise, the elevated temperature may have a detrimental effect on the concrete strength. (Refer to Specification 2407.10.)

Steam jets shall not discharge directly onto the concrete, forms, or test cylinder.

COLD WEATHER WORK

Air temperature and wind velocity measurement shall reasonably represent conditions which exists at the fabricator's site. Concrete placement, curing, inspection and major prestres activities shall meet the requirements of the standard specifications.

COLD WEATHER STRESSING

The maximum jacking stress in prestressing strand shall not exceed 80% of the specified minimum ultimate tensile strength (0.80 f'_s), including the allowances for seating losses and temperature differences.

Prestressing strand that is subjected to stresses exceeding (0.80 f'_s), including the stresses resulting from temperature drop after seating, will be considered unacceptable and subject to rejection. Enclosure and heating of the strands shall be utilized to minimize cold weather stressing problems.

When computing the effect of temperature drop after seating, the allowance for live end seating loss may be added to the available stress for temperature drop. The strand stress at seating, as determined by elongation measurement, shall be considered the base stress when computing the effect of temperature drop. The calculation of stress due to elongation measurement shall be based upon the actual strand area and the modulus of elasticity.

In order to better facilitate fabrication of prestressed beams during cold weather the following alternatives will be allowed:

1. Substitution of 13.3 mm (½ in.) + strand (nominal area = 107.74 mm² 0.167 in.²), one for one, for 12.7 mm (½ in.) regular strand (nominal area = 98.71 mm² 0.153 in.²).This substitution will enable the same total prestress force to be attained at a significantly lower strand stress level, thereby providing a greater range of stress available to compensate for temperature differentials. The 13.3 mm (½ in.) + strand shall be Grade 270 (1860) low relaxation strand complying with ASTM A416/A416M-94, with a minimum breaking strength of 200,615 N (200.6kN) (45,100 lbs.).

   The substitution of 13.3 mm (½ in.) + strand may be made for all strands in the beam or just for the deflected strands only. A mixture of 13.3 mm (½ in.) + strands and 12.7 mm (½ in.) regular strands within the group of deflected strands, or within the group of straight strands, will not be permitted.

   The 13.3 mm (½ in.) + strand substitution alternative is applicable to all beams that specify

12.7 mm (½ in.) regular strands on the beam plan. The plan strand pattern shall not be changed. (**NOTE:** This alternative is not applicable to the bulb-tee beams.)

2. Overnight heating or preheating of the strands is an option for cold weather stressing.

3. Additional strands, of the plan-specified size, may be added to the plan strand pattern. This will enable the plan-specified total prestress force to be attained at a lower strand stress level. The following table lists the details for this alternative for the standard beams that specify the initial prestress at 75 % of f'_s. (f'_s = specified minimum tensile strength of the strand.) It is assumed that the standard beams that specify an initial prestress of 72.62% of f'_s will not present a significant problem of cold weather stressing. However, if the producer wishes to use this alternative for beams that specify the 72.62% of f'_s prestress level, the producer shall submit such a request to the District Materials Engineer, along with the beam stress calculations and details to support the request for approval prior to its use.

STANDARD BEAMS THAT SPECIFY
THE INITIAL PRESTRESS AT 75% OF f'$_s$

BEAMS	ADDED STRANDS (1)	TOTAL STRANDS (2)	Y_b IN. (mm) (3)	TOTAL INITIAL PRESTRESS	% of f'$_s$ (5)
LXA55	2	24	6	SEE NOTE (4)	68.7
(A17M)	2	22	(150)		68.2
LXB67	2	28	6		69.6
LXC75 (C23M)	2	28	4(100)		69.6
LXD80 (C24M)	2	32	4(100)		70.3
LXD90 (D27M)	2	30	4(100)		70.0
LXD95 (D29M)	2	34	8(200)		70.6
LXD100 (D30M)	2	38	8(200)		71.0
LXD105 (D32M)	2	42	8(200)		71.4
LXD110 (D33M)	2	48	10(250)		71.8
BT120 (BT36M)	2	36	6⅜(160)		70.8
BT125 (BT38M)	2	40	6⅜(160)		71.3
BT130 (BT39M)	2	42	6⅜(160)		71.4
BT135 (BT41M)	2	46	6⅜(160)		71.7
BT140 (BT42M)	2	50	6⅜(160)		72.0

Note 1: All added strands shall be straight strands, and shall be the same size as the plan-specified beam strands.
Note 2: The strand pattern shall be the same as the standard plan, except for the additional straight strands, which shall be located as herein specified.
Note 3: The distance from the bottom of the beam to the centerline of added strands. Strands shall be placed laterally two inches centerline to centerline from other strands and symmetrically, one on each side of the beam centerline.
Note 4: Total initial prestress shall be the same as specified on the standard plan.
Note 5: Initial strand stress as a percent of f'$_s$ (if strands are added).

The proposed and the recommended procedures [the enclosure and the preheating of the strands, the use of the 13.3 mm (½ in.) + strands and/or the use of the additional strands] shall be considered as incidental to the cost of the fabrication of the beam.